SOUND BARRIER

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority under 35 U.S.C. § 119(e) to U.S. Provisional Patent Application No. 60/432,431 filed December 11, 2002.

FIELD OF THE INVENTION

The invention relates to sound barriers, and more particularly, to sound barriers used in high traffic areas.

BACKGROUND OF THE INVENTION

Tire and engine noise emanating from cars, trucks and motorcycles is a continuing problem for many neighborhood residents living along highways. Many residents of such neighborhoods are disheartened by the decrease in resale value of their homes and properties due to noise pollution. People, especially children, living in high-traffic areas are subject to stress and possibly serious long-term health implications. Children living in high-traffic areas have been shown to exhibit several common signs of an at least modestly-elevated level of physiological stress, including elevated blood pressure, elevated heart-rate and higher overnight cortisol levels.

In an attempt to solve the problems associated with high-traffic area noise pollution, many State Departments of Transportation (DOTs) have constructed sound barriers. Sound barriers were originally devised to reduce overall noise levels. Effective sound barriers typically reduce noise by as much as 50% or at least by 5-10 dB.

Sound barriers are not always required at locations where an absolute noise threshold is met. There is no standard noise level that requires the construction of a sound barrier. Federal requirements for sound barriers may be found in Title 23 of the U.S. Code of Federal Regulations, Part 772, "Procedures for Abatement of Highway Traffic Noise and Construction Noise."

A sound barrier can reduce the sound entering the community from a high-traffic area by either absorbing the sound, transmitting the sound, reflecting the sound back across the highway, or forcing the sound to take a longer path over and around the barrier. A sound barrier must be tall enough to block the view of a highway from the area that is to be protected, the receiver. To effectively reduce the noise coming around the ends of a sound barrier, the sound barrier can be at least eight times as long as the distance from the home or receiver to the sound barrier. To effectively reduce sound transmission through the sound barrier, the material used to construct the sound barrier must be sufficiently dense and rigid.

Many of the existing sound barriers comprise concrete, masonry, wood, metal, and other sound-reflecting materials, which cause sound waves to travel into nearby residential areas. These sound-reflecting barriers are often constructed from concrete, sacrificing aesthetic appeal, and do not meet acoustical performance standards. Additionally, these barriers require the use of massive machinery and specialized personnel for installation and transportation, are sensitive to stress cracking, and are susceptible to graffiti and vandalism. These sound barriers are solid.

Other existing sound barriers are created from earth mounds or berms. Earth berms have a natural appearance and are usually aesthetically pleasing due to landscaping. Berms reduce noise by approximately 3 dB more than a

vertically-oriented concrete sound barrier, but can require a lot of land and resources to construct.

A major consideration in the design of a sound barrier is its visual impact on the surrounding area. Addressing the size relationship and providing staggered horizontal elements to a sound barrier can reduce the visual impact. Plants and landscaping are sometimes used in the foreground to reduce the visual impact. The visual character of sound barriers in relationship to their environmental setting needs also to be carefully considered.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of a first embodiment of the sound barrier of the present invention.

Figure 2 is a perspective view of a second embodiment of the sound barrier.

Figure 3 is a perspective view of a third embodiment of the sound barrier.

Figure 4 is a perspective view of a fourth embodiment of the sound barrier.

Before one embodiment of the invention is explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangements of the components set forth in the following description or illustrated in the drawings. The invention is capable of other embodiments and of being practiced or being carried out in various ways. Also, it is understood that the phraseology and terminology used herein is for the purpose of description and should not be regarded as limiting. The use of "including" and "comprising" and variations thereof herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In light of the limitations of existing sound barriers described above, new sound barriers are being sought. A need exists for a sound barrier that is light-weight, easily installed and transported, economical, vandalism-resistant, easily maintained and replaced, environmentally-sound, shock-absorbing for increased safety in traffic accidents, crack-resistant and aesthetically pleasing. Each embodiment of the present invention may achieve one or more of these results.

Figures 1-4 illustrate possible embodiments of the sound barrier of the present invention. In some embodiments of the present invention, the sound barrier comprises at least one of low-density polyethylene, linear-low polyethylene, high-density polyethylene, medium-density polyethylene, cross-linked polyethylene and combinations thereof. However, the sound barrier may comprise a variety of sound-absorbing materials, including without limitation, at least one of thermoplastics (such as polystyrene (PS), polyethylene-terepthalate (PET), polytetrafluoroethylene (PTFE), unplasticized polyvinyl chloride (PVC), plasticized polyvinyl chloride (pPVC), polypropylene (PP), polyamide (PA), and the like), thermosets (phenolics, melamine, unsaturated polyester, and the like), elastomers (silicone rubber, natural rubber, polybutadiene, and the like), and combinations thereof without departing from the spirit and scope of the present invention.

The polymer used to create the sound barrier can have a wide variety of order in molecular structure, and can therefore be comprised of any of an amorphous, uncrosslinked thermoplastic, a semi-crystalline thermoplastic of intermediate order, a lightly-crosslinked elastomer, and a highly-crosslinked and

cured thermosetting polymer. Sound barriers comprising polymers can be recycled if damaged in use, thus, creating an environmentally-friendly sound barrier. Examples of crosslinking agents that may be used to produce the sound barrier may include without limitation peroxide, Metton M1534 liquid molding resin, Metton M2150VO liquid molding resin, and Metton M2100VO liquid molding resin.

In some embodiments of the present invention, the sound barrier is fabricated using rotational molding processes. A variety of rotational molding techniques are well-known and readily ascertainable by those of skill in the art. Some examples of rotational molds and rotational molding techniques may be found in U.S. Patent No. 6, 383,437 issued to Grieve on May 7, 2002, U.S. Patent No. 6,296,792 issued to Payne on October 2, 2001, U.S. Patent No. 6,214,272 issued to Gruenwald et al. on April 10, 2001, and U.S. Patent No. 6,030,557 issued to Payne on February 29, 2000, each of which is hereby fully incorporated by reference. Rotational molding is especially useful for economically creating large, seamless parts with uniform thickness and more material in the corners. Rotational molding does not require pre-stressing the material as other plastics processing techniques do, thus increasing the strength and durability of the finished product. Still, other fabrication techniques capable of creating a durable product are possible and within the scope of the present invention, including without limitation blow molding, thermoforming, injection molding, co-injection molding, and the like.

In some embodiments, the sound barrier further comprises UV stabilizers, such as benzophenones and DELRIN 527 UVN C010 medium viscosity grade available from DuPont, which are added to the polymer melt to create a final

product with improved resistance to UV degradation and environmental stress cracking.

The sound barrier of the present invention can be used in any high-traffic or other noisy area, including without limitation airports, residential traffic areas, highways, correctional facilities, industrial applications, loading docks, utility power plants, waste treatment facilities, athletic facilities, pool areas, hospitals, firing ranges, and the like.

In some embodiments, the sound barrier may be hollow or have a void defined therein, and can therefore be packed with a variety of shock- and sound-absorbing materials, particularly, the sound-absorbing materials set forth above. The materials can be found in a variety of shapes and sizes suitable for at least partially filling the void. Some of the embodiments of the present invention may be packed with recycled material, such as ground-up tires and other recycled shock- and sound-absorbing materials. This embodiment creates a sound barrier that is safer in the case of traffic accidents and is environmentally sound. Other embodiments of the present invention are packed with sand. Still, other packing materials, such as gravel, EPS foam and recycled carpet, are possible and within the scope of the present invention. Filling the void with these materials enhances the sound absorbing characteristics of the sound barrier, especially when compared to solid sound barriers.

The sound barrier of the present invention may be easily maintained, replaced and installed, can have a variety of product colors, shapes and surface textures, and may be able to withstand a variety of weather conditions without rotting, rusting, warping, mildewing, molding, freezing, cracking or peeling. The sound barrier of the present invention can be made appropriate for any

environment. In some embodiments of the present invention, the sound barrier may be constructed to look like stones or have a texture and color similar to that of plants or bushes. The walls of the sound barrier may be easily cleaned, reducing the susceptibility to graffiti and vandalism. Additionally, the sound barrier of the present invention has improved resistance to creep rupture and stress cracking and thus is ideal for earthquake-prone geographical regions.

In some of the embodiments, the sound barriers comprise stackable panels, each panel comprising a plurality of ribs, as illustrated in the figures. The ribs can be configured substantially horizontally (FIGS. 1 and 2) or substantially vertically (FIGS. 3 and 4). The ribs can be positive (see FIG. 1 for example) or negative (see FIG. 2 for example), allowing successive barrier panels to be joined together via a tongue in groove or male-female relationship. In other embodiments, successive barrier panels are joined by a plurality of pin-and-hole linkages, snap-fits, rods on a first panel slidably received in a groove on a second panel, and any other joining configuration commonly known to those of ordinary skill in the art.

In some embodiments, the barrier panels can be integrated into existing walls, using H-beams for structural support.

In some embodiments, the barrier has a height of approximately thirteen feet. However, the sound barrier of the present invention can be built in any dimension necessary for each particular application.

EXAMPLE

Installation procedure:

1. Install steel H-beams or pre-cast concrete structures. Beams or posts should be set plumb and in-line with rigging and lifting devices in a safe manner. The beams or posts shall be no more than a ½" greater in width than the barrier panel width or greater in length than the barrier panel length.
2. Lift a barrier panel from an A-frame on a loading truck into position adjacent the H-beams. Barrier panels should be lifted with proper and safe rigging and lifting devices.
3. Fill the barrier panels with expandable foam, reused/recycled tires, or sand.
4. Stack the barrier panels to a desired height ensuring that all barrier panels sit level within any tolerances.